

APPENDIX A

FLIGHT PAYLOAD STANDARDIZED HAZARD CONTROL REPORT FOR THE AMS-02

FLIGHT PAYLOAD STANDARDIZED HAZARD CONTROL REPORT		A. NUMBER STD- AMS-02-1	B. PHASE Phase 0/I	C. DATE January 16, 2001
D. PAYLOAD, DTO, DSO or RME <i>(Include Part Number(s), if applicable)</i> Alpha Magnetic Spectrometer-02 (AMS-02) (See attached list of hardware)		HAZARD TITLE STANDARD HAZARDS		E. VEHICLE Shuttle/Station
F. DESCRIPTION OF HAZARD:	G. HAZARD CONTROLS: <i>(complies with)</i>	H. APP.	I. VERIFICATION METHOD, REFERENCE AND STATUS:	
1. Structural Failure <i>(payloads must comply with the listed requirements for all phases of flight)</i>	a) Designed to meet the standard modular locker stowage requirements of NSTS 21000-IDD-MDK or equivalent IDD_____, or b) Stowed in SPACEHAB per MDC91W5023. <i>Note: Locker and Soft Stowage items only</i>	<input type="checkbox"/> <input type="checkbox"/>	N/A; See Unique Hazard Report #AMS-02-1 for hazard control of structural failure of AMS-02 hardware.	
2. Structural Failure of Sealed or Vented Containers	a) Sealed containers must meet the criteria of NASA-STD-5003, contain a substance which is not a catastrophic hazard if released, be made of conventional metals, and have a maximum delta pressure of 1.5 atm. b) For intentionally vented containers, vents are sized to maintain a 1.4 factor of safety for Shuttle or a 1.5 factor of safety for Station with respect to pressure loads.	<input type="checkbox"/> <input checked="" type="checkbox"/>	a) N/A; The AMS-02 does not have any sealed containers. b) The whole RICH assembly and the TRD octagon enclosure are vented containers. Also, making the TOF and Si Tracker assemblies light tight will create a vented container. The differential pressures between the insides and outsides of these containers during ascent and descent will be minimized by the use of vents in the systems. Verification of the proper factors of safety will be by analysis. Verification of vent sizes by review of drawings and certification of flight hardware conformance to drawings. Status: Open.	
3. Sharp Edges	Meets the intent of one or more of the following: a) NASA-STD-3000 / SSP 50005 b) SLP 2104 c) NSTS 07700 Vol. XIV App. 7 (EVA hardware) d) NSTS 07700 Vol. XIV App. 9 (IVA hardware) / SSP 57000	<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	c) Verification by sharp edge inspections of exposed edges, corners or protrusions on AMS-02 hardware. Status: Open. d) Verification by sharp edge inspections of exposed edges, corners or protrusions on AMS-02 hardware. Status: Open.	

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		STD- AMS-02-1	Phase 0/I	January 16, 2001
D. PAYLOAD, DTO, DSO or RME <i>(Include Part Number(s), if applicable)</i>		HAZARD TITLE		E. VEHICLE
Alpha Magnetic Spectrometer-02 (AMS-02) (See attached list of hardware)		STANDARD HAZARDS		Shuttle/Station
F. DESCRIPTION OF HAZARD:	G. HAZARD CONTROLS: <i>(complies with)</i>	H. APP.	I. VERIFICATION METHOD, REFERENCE AND STATUS:	
4. Shatterable Material Release	a) All materials are contained. b) Optical glass (i.e. lenses, filters, etc.) components of crew cabin experiment hardware that are non-stressed (no delta pressure) and have passed both a vibration test at flight levels and a post-test visual inspection. c) Payload bay hardware shatterable material components that weigh less than 0.25 lb and are non-stressed (no delta pressure) or non-structural.	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	a.1) The Photomultiplier Tubes (PMTs) contain glass windows which will be contained in the PMT housings if broken. Verification by review of TOF, RICH & ECAL drawings and certification of flight hardware conformance to drawings. Status: Open. a.2) The ACOP LCD is glass, but it will have a plexiglass cover to protect it and contain the glass if broken. Verification by review of the ACOP drawings and certification of flight hardware conformance to drawings. Status: Open.	
5. Flammable Materials	a) A-rated materials selected from MAPTIS, or b) Flammability assessment per NSTS 22648	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	a) (Applicable for JSC built hardware) Verification by review of materials lists, review of drawings and inspection of AMS-02 hardware. Verification will be completed by materials certification from EM2/Materials and Processes Technology Branch. Status: Open. b) (Applicable for non-JSC built hardware) Verification by assessment of materials lists, assessment of drawings and inspection of AMS-02 hardware. Verification will be completed by materials certification from EM2/Materials and Processes Technology Branch. Status: Open.	
6. Materials Offgassing	a) Offgassing tests of assembled article per NASA-STD-6001	<input type="checkbox"/>	N/A; See Unique Hazard Report #AMS-02-2 for hazard control of offgassing of AMS-02 materials.	
7. Nonionizing Radiation 7.1 Non-transmitters	a) Pass NSTS 21288 / SSP 30237 EMI compatibility testing, or b) NSTS/MS2 approved analysis	<input checked="" type="checkbox"/> <input type="checkbox"/>	a) EMI tests will be performed on components of the AMS-02. Final verification will be by NASA approval of the EMI testing report per NSTS 21288 and SSP 30237. Status: Open.	

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F. DESCRIPTION OF HAZARD:	G. HAZARD CONTROLS: <i>(complies with)</i>	H. APP.	I. VERIFICATION METHOD, REFERENCE AND STATUS:	
10. Electrical Power Distribution	a) Shuttle payload - Meets all circuit protection requirements of Letter TA-92-038. b) Station payload - Meets station interface circuit protection requirements of SSP 57000 and payload circuit protection requirements of Letter TA-92-038.	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	a & b) Verification by review of AMS-02 and ACOP power distribution drawings. Status: Open; See AMS-02 and ACOP preliminary power distribution schematics. [NOTE: Schematics were too large for this document, please find as separate submittals. (Figures 5.11.1 and 5.13.5)]	
11. Ignition of Flammable Atmospheres in Payload Bay	All ignition sources are controlled as required in Letter NS2/81-MO82, and MLI grounded per ICD 2-19001.	<input checked="" type="checkbox"/>	a) 28V power will be available from the Standard Switch Panel (SSP) to operate a solenoid which will open a He Vent Valve during launch and close it during landing. Any potential ignition sources will be controlled per letter NS2/81-MO82. Verification by assessment, review of drawings, and inspection of hardware. Status: Open. b) MLI blankets will be grounded per ICD 2-19001. Verification by review of drawings, inspection of hardware and MLI grounding tests. Status: Open.	

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12. Rotating Equipment	Rotating equipment meets criteria of NASA-STD-5003 for obvious containment.	<input checked="" type="checkbox"/>	<p>a) The ACOP drawer assembly 4.5 inch diameter, 5200 nominal rpm, fan will be covered on the inlet and outlet sides by a 1/4 inch welded 0.032 diameter stainless steel mesh. The fan will be installed on the back of the International Subrack Interface Standard (ISIS) drawer and will be enclosed by aluminum panels. (See attached figures) The design will comply with section 4.2.2.2 of NASA-STD-5003. Verification will be by review of drawings and certification of flight hardware conformance to drawings. Status: Open.</p> <p>b) The ACOP drawer assembly has five 7200 maximum rpm Hard Drives (HDs) in hot swap bays. Each HD contains a 3.75 inch diameter disk that weighs 23 grams. Each HD hot swap bay contains a 1.4 inch diameter, 6500 maximum rpm, shrouded ball bearing type fan. The design will comply with section 4.2.2.2 of NASA-STD-5003. Verification will be by review of drawings and manufacturers' specifications, and certification of flight hardware conformance to drawings. Status: Open.</p> <p>c) The TRD gas system has 2 small 212 gram circulation pumps (one is a backup). Each pump has a 5000 maximum rpm, 24 Vdc brushless motor enclosed in a housing. The rotor shaft (moment of inertia is 1.2g mm2) drives an eccentric and screw (2.6 grams), a piston rod (1.4 grams) and a ball bearing (2.9 grams). The design will comply with section 4.2.2.2 of NASA-STD-5003. Verification will be by review of drawings and manufacturers' specifications, and certification of flight hardware conformance to drawings. Status: Open.</p> <p>d) The TCS rotating equipment is TBD. The design will comply with section 4.2.2.2 of NASA-STD-5003. Verification will be by review of drawings and manufacturers' specifications, and certification of flight hardware conformance to drawings. Status: Open.</p>	

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13. Mating/demating power connectors	Meets all requirements of Letter MA2-99-170.	<input checked="" type="checkbox"/>	<p>Three primary (1 power & 2 data) and three redundant (1 power & 2 data) connectors will be mounted on an interface panel on the USS-02, near the Umbilical Mechanism Assembly, and will be EVA accessible. The redundant power (120 V dc) connector will be available for contingency EVA mating/demating for mission success (not required for safety) in the event of ISS bus failure or an AMS-02 failure. The redundant data connectors (less than 32 V dc) will be available for contingency EVA mating/demating for mission success (not required for safety) in the event of an AMS-02 failure. EVA mating/demating of these connectors will comply with NASA Letter MA2-99-170. Verification will be by a mate/demate assessment, review of AMS-02 drawings, certification of flight hardware conformance to drawings and review of flight procedures to ensure note for removing power from the 120 V dc connectors prior to mating/demating.</p> <p>Verification of proper mate/demate of ACOP HDs will be by procedure.</p> <p>Status: Open.</p>	
14. Contingency Return and Rapid Safing	a) Shuttle payload - Meets all rapid safing requirements of Letter MA2-96-190. b) Station payload - Meets rapid safing requirements of Letter MA2-96-190, and design shall not impede emergency IVA egress to the remaining adjacent pressurized volumes.	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	a & b) Verification by review of contingency return and rapid safing procedures. Status: Open.	
APPROVAL	PAYLOAD ORGANIZATION		SSP/ISS	
PHASE I	ORIGINAL SIGNED BY JAMES R. BATES ON 1/17/01		ORIGINAL SIGNED BY AXEL M. LARSEN ON 1/17/01	
PHASE II				
PHASE III				

AMS-02 Hardware Covered by Hazard Report #STD-AMS-02-1:

Cryogenic Superconducting Magnet (Cryomag)

Unique Support Structure-02 (USS-02) (which includes the vacuum case for the cryomag)

Synchrotron Radiation Detector (SRD)

Transition Radiation Detector (TRD)

Time-Of-Flight (TOF) Scintillator Assemblies

Ring Imaging Cherenkov Counter (RICH)

Electromagnetic Calorimeter (ECAL)

Data and Interface Electronics

Electrical Cables

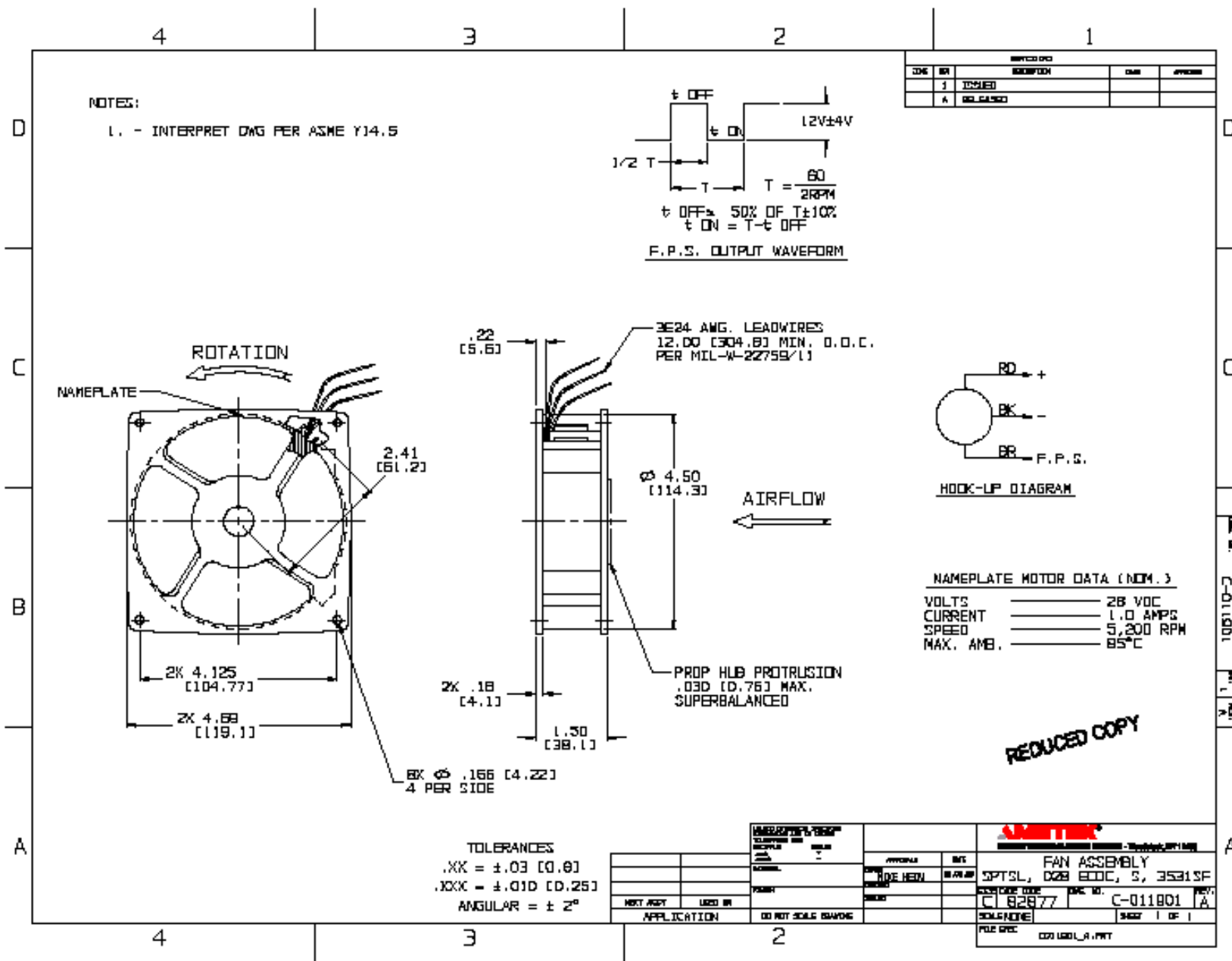
Two Monitoring and Control Computers (MCCs)

Power Distribution Box

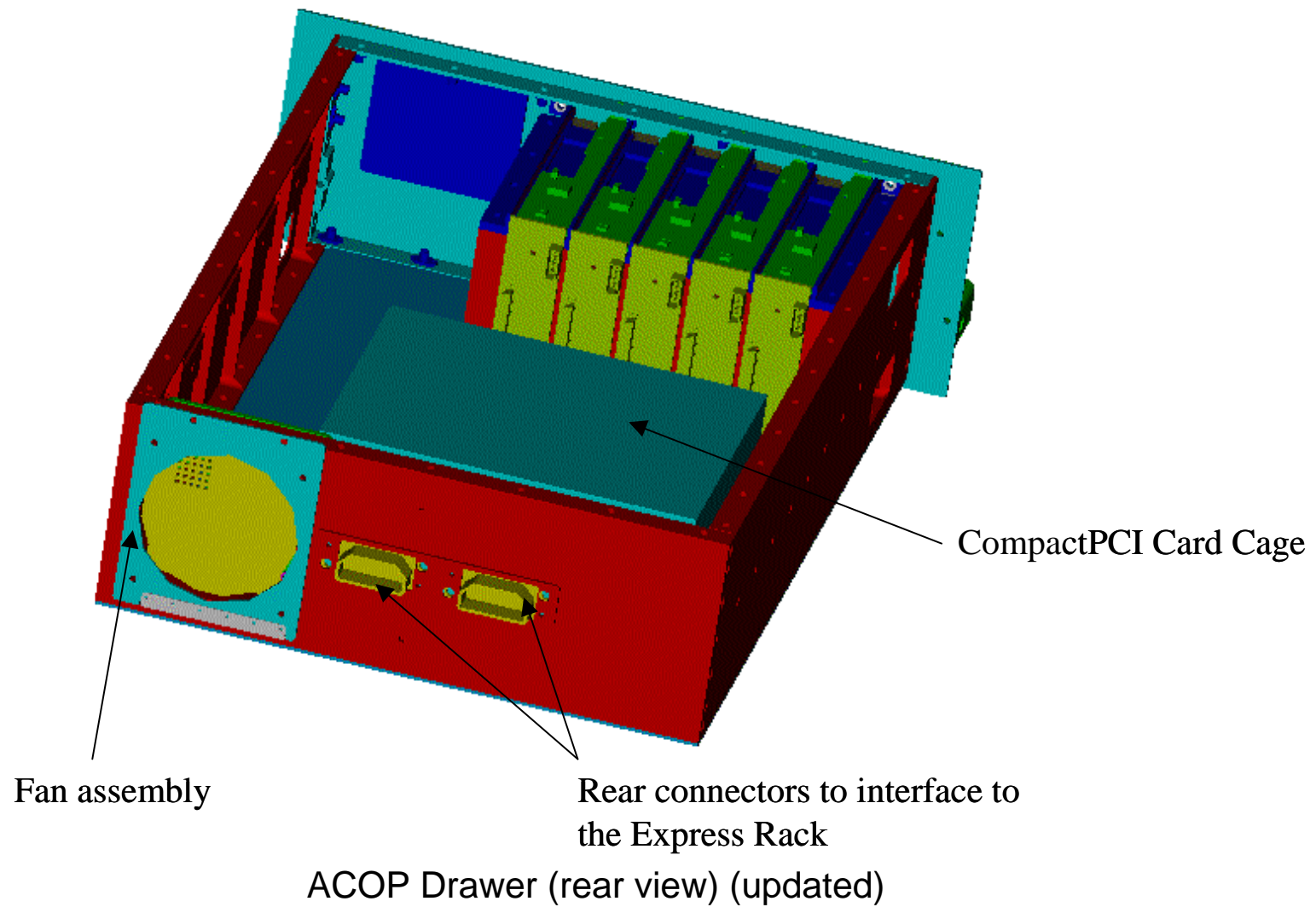
AMS Crew Operations Post (ACOP)

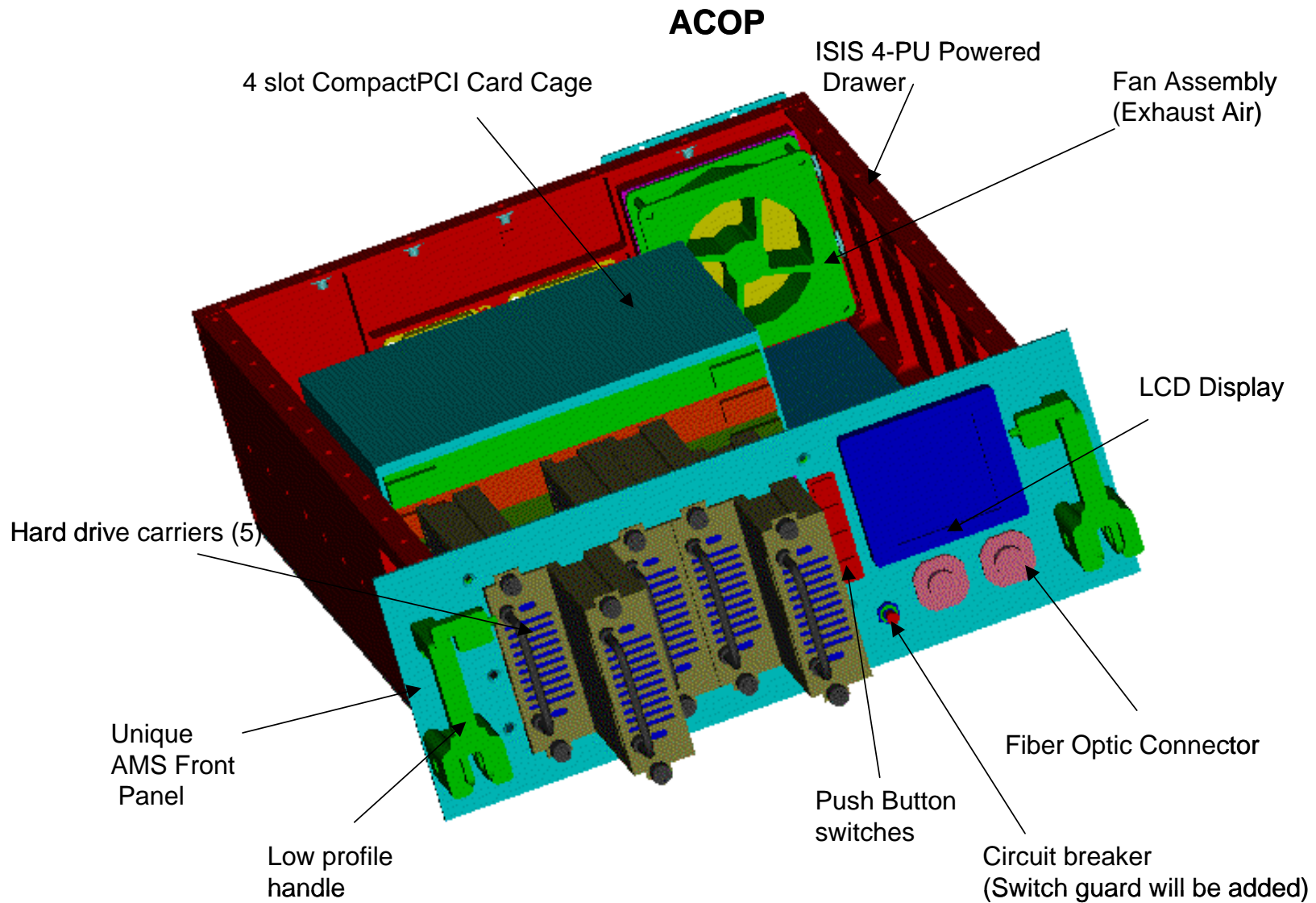
Passive Payload Attach System (PAS)

Meteoroid and Orbital Debris (MOD) Shields



Rear View





ACOP Drawer (front view) (updated)